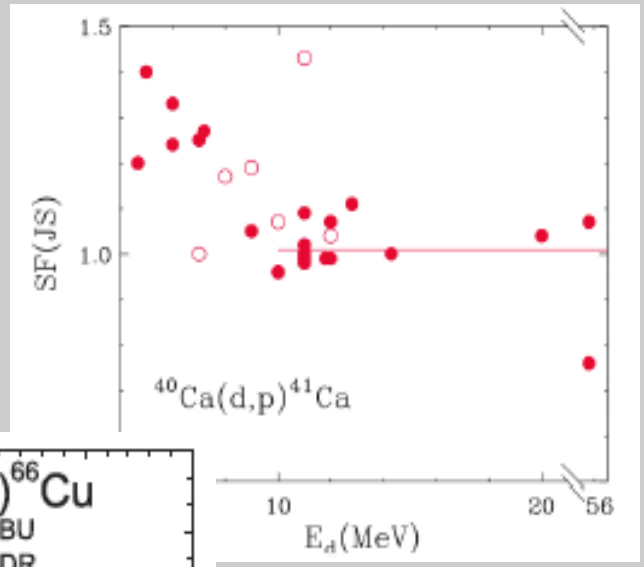
Deuteron Induced Reactions

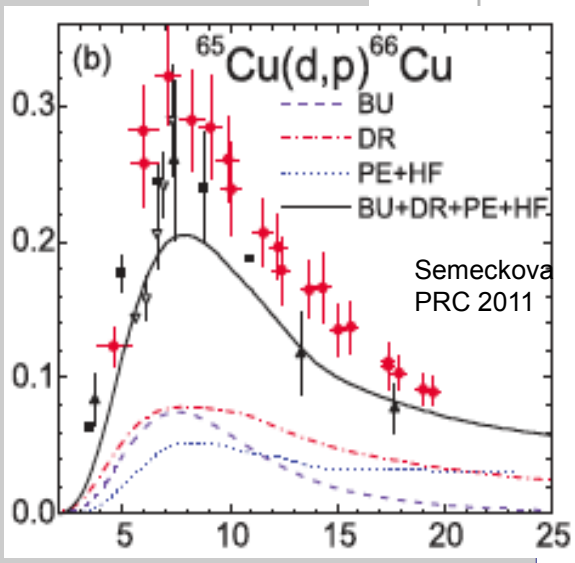
- Direct reactions
  - Study of nuclear structure: single-particle states.
  - Can be used as a target: single-particle structure of exotic nuclei investigated in inverse kinematics experiments.
- Compound nucleus reactions
  - Mechanism of compound nucleus formation.
  - Partial fusion processes.
  - Surrogate for neutron capture reaction: direct applications in astrophysics, nuclear reactors, national security.

Present Status

A valuable tool: structure info from (d,p)

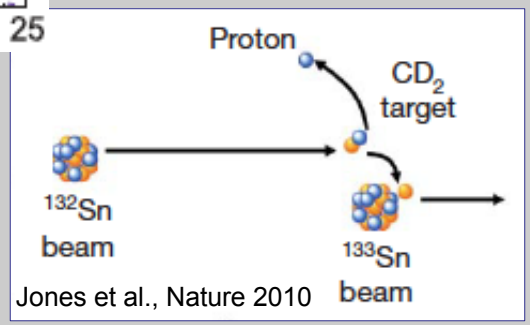
- Probe of nuclear structure, strong force
- Extensive use for decades
- Understanding reaction mechanisms crucial for extracting info: Butler theory, DWBA (zero-range & finite-range), CC approach, breakup





Focus on unstable isotopes

- Radioactive beam experiments identified as *the way forward* for breakthrough discoveries
- Probing structure in inverse kinematics
- Indirect cross sections measurements



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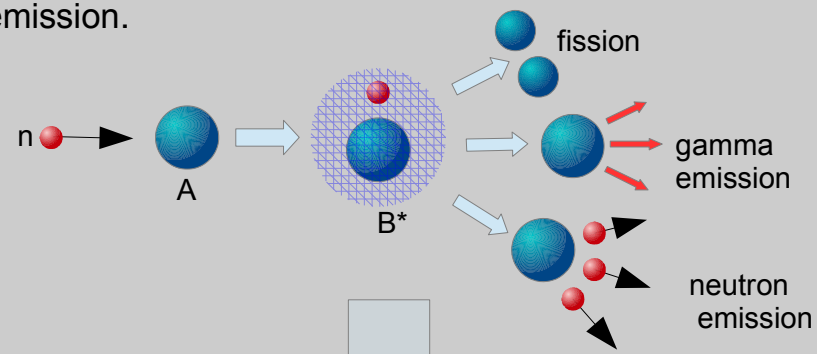
Future Challenges

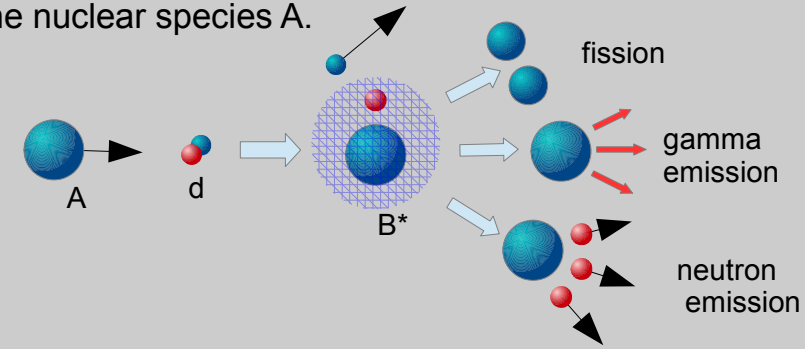
- Current descriptions of (d,p) not adequate
- Comprehensive description of (d,p) is needed, including all possible reaction mechanisms
- Poor understanding of fusion processes: unwanted background in structure studies, but crucial component in indirect cross section measurements

Surrogate for neutron capture

* Desired reaction: neutron induced fission, gamma emission and neutron emission.



* The surrogate method consists in producing the same compound nucleus B* by bombarding a deuteron target with a radio active beam of the nuclear species A.



* **A theoretical reaction formalism that describes the production of all open channels B* is needed.**